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(54) IMPROVEMENTS TO MODULAR ELEMENTS FOR CONSTRUCTING HYDRAULIC AND SUBAQUEOUS STRUCTURES

(71) I, MAURICIO PORRAZ JIMENEZ LABORA, a Mexican citizen, of Gutenberg No. 47 80. Piso, Mexico 5, D.F., Mexico, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to modular elements for constructing hydraulic and subaqueous structures as described in my co-pending British patent application No. 44152/74 (Serial No. 1485470). The expression "hydraulic" is used to refer to structures which control, direct or channel flowing water.

These elements are formed by a flexible envelope which is provided with valve devices which enable the element to be filled, at the point where it is to be used, with a solid material (a mixture of sand and cement) which is injected under pressure.

The flexible envelope has the advantage that, when the element is placed in position, it is able to adapt to the configuration of the bed and to other elements which are already in position.

However, in certain applications, due to the way in which the flexible envelopes deform when filled under pressure, and in particular when the filling material is a quick-setting cement, the final shape assumed by the elements is not the one best suited for their function in the structure which is planned.

The present invention proposes to overcome or minimize this drawback and to give the element the final shape required, without at the same time losing the advantages which result from the flexibility of the envelope, and while providing the additional advantage of pre-stressing the filling substance to a certain extent.

Accordingly, the invention consists in a modular constructional element comprising a flexible envelope having an inlet valve for admitting a solidifiable fluid substance under pressure, said envelope also being provided with elongated reinforcing members which are expandable to create pressure on said

substance until the substance is finally solidified.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawings which show some embodiments thereof by way of example and in which:—

Figure 1 is a partly cut-away perspective view of a modular constructional element which is provided with reinforcing and pre-stressing means arranged between opposing side-walls of its envelope,

Figure 2 is a side-view of a modular constructional element the envelope of which is provided with members for confining its transversely, and

Figure 3 is a side-view, partly in cross-section, of a modular constructional element provided with internal reinforcing members and with a detachable external fitment for protecting these members.

Referring now to the drawings, in Figure 1, the element consists of an envelope 1 made of a flexible material, which is intended to hold cement or some other fluid solidifiable filling substance which is represented by the dots 2. This substance is introduced under pressure through an orifice 3 which is fitted, as described in the aforementioned specification, with a suitable valve.

Elongated reinforcing members 4 are fixed between the opposing walls of the envelope. These members may possibly form an integral part of the envelope if the material is such as to allow them to be produced when the envelope is moulded. The length of the members 4 when not under load is less than the corresponding inside dimension of the envelope when in the expanded state, and they are formed from a material having high mechanical strength which is capable of sufficient extension to allow the envelope to expand to a certain degree when the filling material is introduced under pressure. The result is that members 4, by virtue of their mechanical strength and elasticity characteristics, restrict and modify the way in which the element deforms when filled while increasing its mechanical strength.

Furthermore, a pre-stressing action is

exerted on the filling substance while it is in a plastic state, that is to say in the case of a cement, before it sets. This too results in an improvement in the mechanical strength of the element and crevices are prevented from forming.

In Figure 2 is shown an envelope 5 fitted with members 6, 7, 8 for confining it transversely. This embodiment makes it possible to reduce the volume of filling substance required to cover a given area. As a modification, the confinement could be longitudinal and could enclose the side-wall of the envelope in order to restrict its vertical expansion. By arranging the confining members in a suitable manner, it is possible in the end to obtain the desired shape for the member once filled, which considerably increases its possible uses, in particular as a result of the opportunity which it provides of placing the constructional element in positions close to the vertical and on slopes.

In Figure 3, two rigid plates 10 and 11, which are attached to the walls of the envelope 9 at the time of filling, are shown arranged on two of the lateral faces of the envelope. In conjunction with a series of rigid bridge-pieces, one of which is seen in cross-section at 12, these plates form a detachable fitment to provide external protection for internal reinforcing and pre-stressing members such as 13, 14, 15, 16. Plates 10 and 11 may be attached to the ends of transverse members such as 13 by means of nuts 17, 18 for example. When the filling substance such as cement has set, the protective fitment is removed. Such a fitment enables the filled constructional element to be given a substantially parallelepiped shape.

The reinforcing, pre-stressing, confining and protective members shown in the drawings may be formed from various suitable materials, e.g. plastics materials or metal, and may be of the most diverse forms; strips, cords or plates. Their number and arrangement and the method of attaching them to or incorporating them in the element may

vary depending on the objects being sought. Since they are to exert a pre-stress on the filling substance while it is setting, they obviously need to be of suitable length and to be possessed of a certain degree of elasticity.

WHAT I CLAIM IS:—

1. A modular constructional element comprising a flexible envelope having an inlet valve for admitting a solidifiable fluid substance under pressure, said envelope also being provided with elongated reinforcing members which are expandable to create pressure on said substance until the substance is finally solidified.

2. An element as claimed in claim 1, wherein the elongated members are arranged within the element between opposing walls thereof, the length of said members when not under load being less than the distance between said walls.

3. An element as claimed in claim 1, wherein said elongated members are located externally of the envelope.

4. A modular element as claimed in claim 2, wherein rigid parts are temporarily attached to the walls of the envelope for protection thereof and are removed when the fluid substance has set.

5. A modular constructional element substantially as hereinbefore described with reference to Figure 1 of the accompanying drawing.

6. A modular constructional element substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

7. A modular constructional element substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

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